

ENDOCRINE SYSTEM

Pregestational hormone
progesterone

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AIR 1747

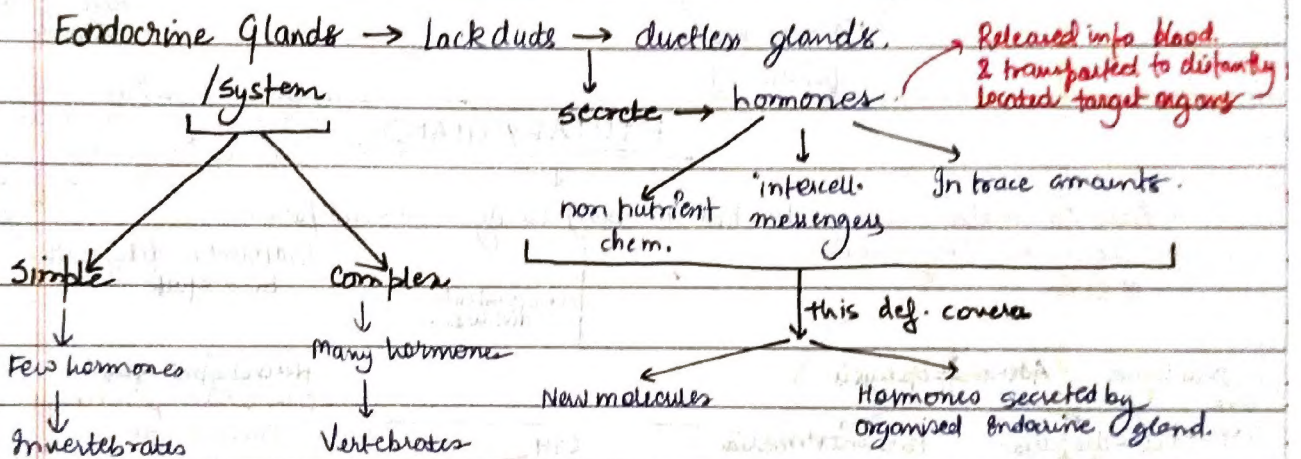
NCERT THREAD NOTES

Neural system → point-to-point
Rapid Co-ord.
Fast
Short lived

Nerve fibres do not innervate all the cells of body & the cellular functions need to be regulated → Thus came Endocrine System

↓ carried by
Hormones.

jointly co-ord. & regulate physiological func. in body



Human Endocrine System →

Endocrine glands

↓
Organised

Pituitary
Pineal
Thyroid
adrenal
pancreas
parathyroid
Thymus
gonads

hormone producing diffused tissue/cells located in diff parts of body

* In addition to these → some other organs

- ① Gastrointest. tract
- ② Liver, Kidney
- ③ heart

→ hormones

Hypothalamus not written here in NCERT mentioned separately as "of all major endocrine glands & hypoth."

HYPOTHALAMUS

Basal part of diencephalon (forebrain)

Regulates wide spectrum of body funct.

Contains several groups of neurosecret. cells

"nuclei"

hormones

Regulate the synthesis & secretion of pituitary hormones

Releasing hormone

stimulate pit. secretion

GnRH → stimulate gonadotrop. release from pit.

Inhibiting hormone

Inhibition of pit. secretion

Somatostatin → inhibits the growth hormone release from pit.

Ant. pituitary → Hormones reach through portal circulatory system

regulate the function of.

Post. pituitary → Under

direct neural reg. of hypothalamus

PITUITARY GLAND

hormones from it regulate growth & activities develop. of somatic tissues & activities of peripheral endocrine glands

Located in bony cavity → sella turcica

Attached to hypoth. by a stalk.

anatomically divided.

- Acts on melanocyte
- Regulate pigmentation of skin

produce size tropic hormones (Ant. pituitary)

Adenohypophysis

GH
PRL
TSH
ACTH
LH
FSH

Pars intermedia

MSH (Melanocyte stimulating hormone)

GH

Over

Gigantism
abnormal growth
(In child age over secret. hater.)

Deficient

Pit. dwarfism
stunted growth
(In child age deficient hater.)

Neurohypophysis (posterior pituitary) pars nervosa

"STORES" & "RELEASES"

Oxytocin
Vasopressin

"synthesized" in hypothalamus & transported axonally to post. pituitary.

* However, pars intermedia is almost merged with pars distalis, in HUMANS

Prolactin

Regulates growth of mammary glands

Formation of milk

TSH → stimulates the "synth." & "secr." of thyroid horm. from its gland.

ACTH → stimulates the "synth." & "secr." of steroid hormone (glucocorticoids) from adrenal cortex.

Over secretion of GH in adults: Acromegaly

• In adult or middle age especially

- Severe disfigurement (of face)
- Serious complications
- Premature death if unchecked.
- Hard to diagnose in early stage
- Goes undetected for many years
- Changes in int. feat. become noticeable

Gonadotroph. (stimulate gonadal activity)

LH

FSH

Male

Female

Male

Female

stim. synth. & secr. of horm.

Induce ovulation of follicle

Along with androgen + FSH, it regulates spermatogenesis.

stimulate growth of

called androgen from testes

& maintains C.L. Remnant of gray follicle

development of ovaries in female

Oxytocin → Acts on smooth muscle → cause contraction
 Pitocin → In Females → stimulates a vig. contr. of uterus at child birth
 → milk ejection from mammary gland.

Vasopressin → Acts on kidney → Stimulates reabsorption of water & electrolytes by distal tubules & thereby reduce loss of water through urine (diuresis).
 ADH

* Impairment affecting synth. or release of ADH → water loss & dehydo. → Diabetes insipidus

THE PINEAL GLAND

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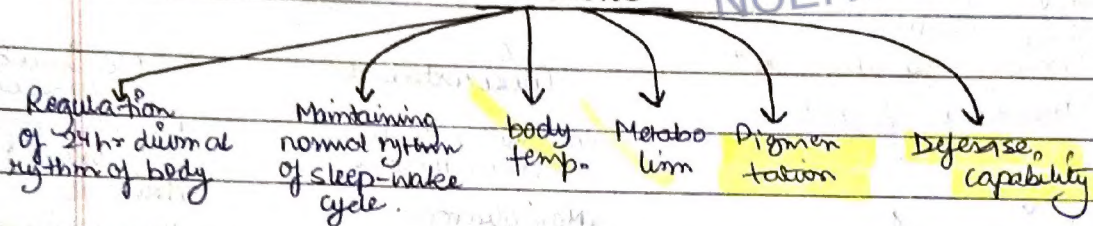
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NCERT THREAD NOTES

Location — Dorsal side of forebrain

Secretions — melatonin

Functions



* Iodine is essential for normal rate of hormone synthesis in thyroid.

THE THYROID GLAND

Location & Two lobes on either side trachea

Connected by a thin flap of connective tissue "Isthmus".

Secretes a protein hormone TCT which regulate blood calcium level (decrease Ca^{2+}) → Calcium homeostasis

Follicles

Follicular cells enclosing a cavity.

T_4
 (Tetraiodothyronine or Thyroxine)

T_3
 (Triiodothyronine)

Stromal tissues

Thyroidism

Hypo

Goitre (enlargement of thyroid gland)

- During pregnancy
- Defect. dev. & maturation of growing baby
- Stunted growth (cretinism)
- mental retardation
- low intelligence quotient
- abnormal skin
- deaf-mutism

• In adult women, irregular menstrual cycle

Hyper

Due to causes of thyroid gland & due to development of nodules of thyroid glands, the rate of "synth" & "secret" becomes abnormally high

Exophthalmic goitre

- Enlargement of thyroid gland
- Protrusion of eye ball
- Increased basal metabolic rate
- Weight loss
- "Grave's disease"

* Thyroid hormone :

- Regulates basal metabolic rate
- Support excretion
- Controls metabolism of protein, carbohydrates & fats.
- Maintenance of water & electrolyte balance.

→ Maturation of central nervous system

PARATHYROID GLAND

"Four glands present"

Location : Back side of thyroid gland

One pair each in two lobes of thyroid gland

Secretes : PTH → peptide hormone



Its secretion is regulated by circulating levels of calcium ions.

Function :

→ PTH, ↑ the Ca^{2+} in blood.

→ PTH, acts on bones & stimulates bone resorption (dissolution/demineralisation)

→ PTH, stimulates reabsorption of Ca^{2+} by renal tubule & ↑ Ca^{2+} absorption from digested food.

→ Hypercalcaemic

Along with TCT, balances calcium levels in body

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Thymus

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"Lobular structure"

~~Function~~ : b/w lungs
Location : behind sternum

On ventral side of aorta

Function : Develop. of immune system.

Secretes : Thymosin → peptide hormone

↳ helps in differentiation of T-lymphocytes

↓
provide cell mediated immunity.

* Thymosin also promote prod. of antibodies
hence to provide humoral immunity.

* Thymus → degenerated → Old individuals

↓
Decreased production
of thymosin

Immune responses of
old person become
weak.

ADRENAL GLAND

(One pair)
(anterior part of each kidney)

steroids

secrete many hormones

Centrally located
(Adrenal Medulla)

Outside
(Adrenal cortex)

- Adrenaline/epinephrine
- Noradrenaline/norepinephrine

Catecholamine

Rapidly secreted in response to stress of any kind & during emergency situation

"emergency hormones"
"Hormones of fight or flight"

These hormones

- Alertness
- Pupillary dilation
- Piloerection
- Sweating
- Heart beat
- Strengthening of heart contract.
- Rate of resp.
- Glycogenolysis (glucose ↑ in blood)
- Lipolysis
- Proteolysis

Zona reticularis

inner

secrete cortisol

Zona fasciculata

middle

glucose

Zona glomerulosa

outer

mineralocorticoids

Corticoids

Glucocorticoid

involved in carb. hydrate metab.

Main glucocort.

Cortisol

Stimulate:

- Gluconeogenesis
- Lipolysis
- Proteolysis
- Inhibit cellular uptake
- Utilisation of amino acids

Maintaining

Stimulate GFR

Anti-inflammatory react.

Suppress immune response

Stimulate RBC production

Mineralocorticoids

Regulate balance of water & electrolytes

Main mineralocort.

Aldosterone

Acts on renal tubules

Stimulate:

- Reabsorp. of Na⁺ & water
- Excretion of K⁺ & phosphate ion

Maintains:

- Electrolyte
- body fluid volume
- osmotic press.

Blood press.

Androgenic steroids

by cortex

- growth of
- axial hair
- pubic hair
- facial hair
- during puberty.

Inflammatory rxn - Basophils

Anti-inflammatory rxn - Glucocorticoids

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NCERT THREAD NOTES

PANCREAS

Composite gland.
(acts as both exo & endo - ~~crine~~ gland)

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Exocrine

↓
Enzymes

Digestion related

endocrine

1 to 2 million islets of Langerhans.

This is only 1-2% of pancreatic tissue!

TESTIS

A pair in scrotal sac (outside abdomen)

Perform dual function

Primary sex organ

Endocrine gland.

Testis

Seminiferous tubules

Stromal or interstitial tissue

* Leydig cells / Interstitial cell

present in intertubular space

produce androgen mainly ~~testosterone~~ hormone.

Regulate develop. & maturat. function.

of male access. sex organ

- epididymis
- Vas deferens
- Seminal vesicle
- Prostate
- Urethra

These hormones stimulate

- Muscular growth
- growth of facial / axillary hair
- aggressiveness
- low pitch of voice

Androgens play stimulatory role in

→ spermatogenesis

act on CNS & influence male sexual behaviour (libido)

synthetic

→ Anabolic effect on protein & carbohydrate metabolism

α-cell

↓
glucagon

"Peptide hormone"

→ Maintains normal blood glucose level

→ Acts on liver cell (hepatocyte)

→ glycogenolysis

→ hyperglycemia

→ gluconeogenesis

→ Reduces the cellular glucose uptake & utilisation

Hyperglycaemic hormone.

β-cell

Insulin

"peptide hormone"

→ Regulation of glucose homeostasis.

→ Acts on adipocytes & hepatocytes

→ ~~glycogenesis~~ glycogenesis

→ Hypoglycemia

→ Enhances cellular glucose uptake & utilisation

→ Rapid movement of glucose from blood to hepatocyte & adipocyte.

* Prolonged hyperglycemia

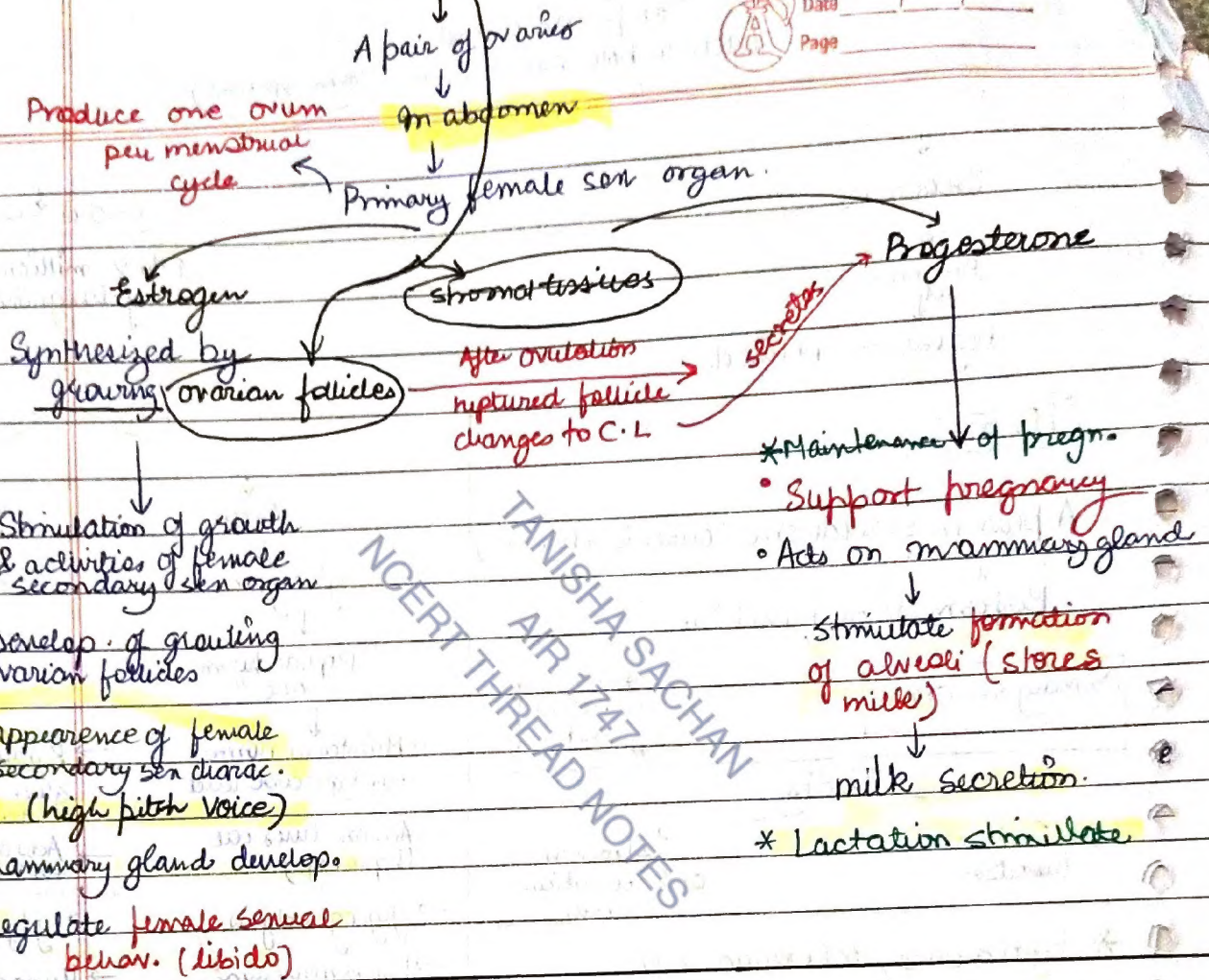
↓
Complex disorder

↓
Diabetes Mellitus

- loss of glucose through urine
- form. of harmful comp. ketone body

Diabetic patient are successfully treated with insulin therapy.

OVARY



HORMONES OF HEART, KIDNEY, GIT

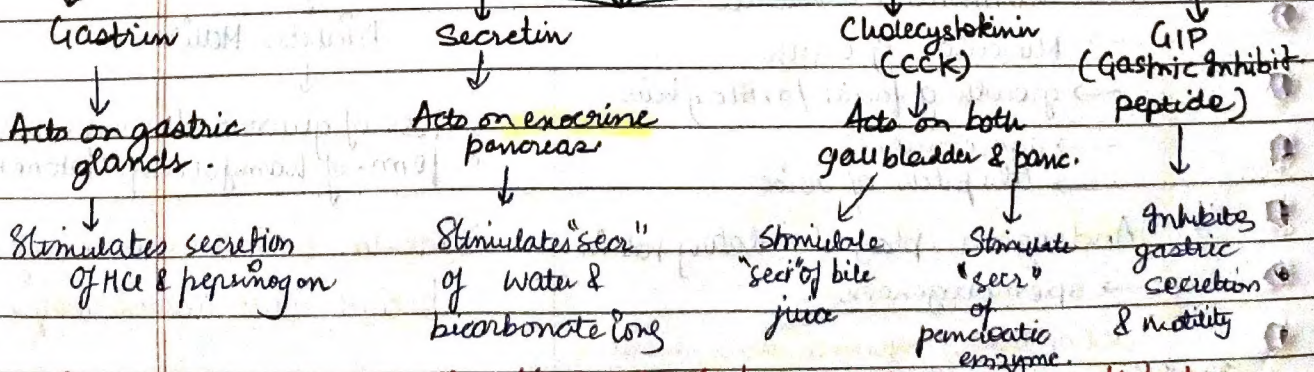
ANF → peptide hormone
by atrial wall of our heart
→ ① reduce BP ② dilation of BV

Erythropoietin → peptide hormone
by juxtaglomerular cells of kidney
→ stimulates erythropoiesis

These hormones regulate the secretion of digestive juices & help in digestion.

Endocrine cells in diff. parts of GIT

4 peptide hormones



* Several other non-endocrine tissues secrete hormones called growth factors. These factors are essential for normal growth of tissues & their repairing / regeneration.

MECH. OF HORMONE ACTION



Date _____
Page _____

- Hormones produce their effect on target tissue by binding to specific protein called hormone receptor.

located in target tissues only

Membrane bound recept.

On the cell memb. of target cell

* intracellular recept.

Inside target cell.

* Mostly nuclear receptor (inside nucleus)

* Hormone + Receptor → hormone-receptor complex.

★ Each receptor is specific to one hormone only & hence ~~receptor is specific to one hormone only~~ & hence receptor is specific.

Leads to certain biochemical changes in target tissue.

Target tissue metabolism hence physiological function are regulated by hormones

On the basis of chemical nature →

i) Peptide, polypeptide, protein

- insulin
- Glucagon
- Pit. hormones
- hypothalamic hormones
- TCT
- ANF
- PTH
- Thymosin



ii) Steroids



- cortisol
 - testosterone
 - estradiol
 - progesterone
 - Aldosterone
 - Sex corticoid
 - Mineral corticoid
- (All corticoids)

iii) Iodothyronines



- Thyroid hormones

iv) Amino acid derivatives



- epinephrine ; nor epinephrine

Hormones which
interact with membrane
bound receptor



Do not enter target cell



Generate second messenger



cyclic AMP, IP_3 , Ca^{2+}



Regulate cellular metab.

→ PROTEIN HORMONES

→ Amino acid derivative

Hormones which
interact with
intracellular receptor



Regulate gene
expression

or

Chromosome funct.
by interact.

of hormone receptor
complex with
genome



Cumulative bioch
emical actions

result in physiolog.

& developm. effects.

→ steroid

→ Iodothyronines